EXHIBIT B

Part 3 of 6

Electrical System

General Practices

Note: See program specific BBLB documents for recommended electrical connection points for commonly installed equipment.

Note: When the battery cables are disconnected from the battery, the PCM, radio, and other memories will be lost. The vehicle's engine performance and transmission shift schedule will also be affected until the Powertrain Control Module (PCM) "relearns" the lost data. This action usually requires a few miles of normal driving.

Prior to arc welding or plasma cutting on the vehicle, disconnect the battery's negative (ground) cable(s) and ALL connectors leading to sensitive modules (PCM, BCM, ABS, Instrument Cluster, GPM, NOx, SCR, TCM etc.). Disconnecting the battery cable(s) alone is not enough to prevent damage to electronic modules.

Be cautious when connecting and disconnecting electrical connectors to avoid damage to contact pins and contamination in the connector interface.

It is strongly recommended that wiring in areas of heavy rework, or in areas where welding operations are to be performed, be removed prior to the rework operations and reinstalled after the rework is completed. If wire removal is not practical, the wires must be shielded from damage due to the rework and welding heat. All components and wiring should be reinstalled as closely as possible to the original factory installation.

Prior to any alterations of the vehicle electrical systems, the battery's negative (ground) cable(s) must be disconnected and positioned to prevent re-contact with the negative post. This precaution will minimize the potential for dead batteries and possible damage to vehicle circuitry.

Do not modify the OEM wiring to the Powertrain Control Module (PCM).

Do not splice into the stop lamp switch as this can interfere with the proper functioning of PCM, speed control, and anti-lock brake electronic modules.

The vehicle Ignition circuit should not be altered.

Modification to the OEM starting system or wiring is not recommended.

An electrical load analysis must be performed prior to adding loads to existing OEM fused circuits. The total circuit current draw (including additional load) must not exceed 80% of the OEM circuit current protection rating for fuses located in the passenger compartment and 60% of the OEM circuit current protection rating for fuses in the engine compartment.

Be very cautious not to exceed the circuit limitations when driving additional electrical load directly from a Body Control Module (BCM) output. It is preferred to use the BCM output to drive an auxiliary relay coil if there is any question whether the BCM driver is adequate for the application. If the BCM driver is overloaded, the output may be temporarily disabled or permanent damage may occur to the BCM, requiring its replacement. Relay selection is important and depends on current requirements, number of cycles expected in the relay lifetime, whether the relay is to be operated intermittently or for long periods of time, and whether the relay is exposed to weather conditions or is installed in a protected area. When the current requirements of a circuit exceed the capacity of an available relay, more than one relay can be used if the circuit is wired to split the load.

When adding circuits with higher demands than the host OEM circuit can provide, relays should be incorporated into the system. The OEM wiring may be utilized as a signal source for the relay coil. Power to the added circuit should be supplied directly from the vehicle battery or additional aftermarket battery(s) through the relay.

All installed equipment that utilize electric motors should have a discharge path for the reverse voltage generated by the motors when power is turned off. Failure to provide a discharge path can result in damage to other electrical equipment installed by the modifier or Ford Motor Company. Resultant damage to Ford electrical devices may not be repaired under warranty. The equipment manufacturer can provide information about the presence of a discharge path on their electric motors.

Any added alternator must be Ford OEM or equivalent. Modifications to vehicle charging systems must be done in a manner that does not cause electrical overload of the OEM wiring, overcharging of batteries, etc. Consult the Ford Truck Body Builders Advisory Service prior to incorporating any charging system modification.

Do not move, alter, or add circuits to OEM electrical ground points. Do not ground the body to the transmission or transmission cross member. Ground the Second Unit Body to the frame in at least two locations, and if required, add an additional frame to engine ground cable to improve the ground path to the battery.

After all electrical or vehicle modifications, perform the on-board diagnostics procedures as described in the powertrain control/emissions diagnosis manual to clear all diagnostic trouble codes (DTCs). In addition, perform self-test to the BCM and test all lighting outputs. Road test vehicle and rerun the on-board diagnostics to verify that no DTCs are present. If DTCs are generated, perform the appropriate diagnostic procedures and repairs. Vehicle operation (engine, transmission, and lighting) may be affected if DTCs are not serviced.

Accessing Power

Some Ford vehicles are equipped with conveniently located electrical wiring taps. Most taps are fused, having locations under the instrument panel, in the engine compartment, and/or at the rear of the frame. Program specific BBLBs will provide details on the locations and limitations of these circuits, if provided.

Do not tap (piggyback) into either side of any fuse in the OEM interior fuse panel or under-hood power distribution box, or splice into any power circuit that feeds into either one of these components.

The power supply wire for added circuits from the battery should be properly sized, include appropriate fusing, and should be connected as follows:

- For circuits requiring a maximum total of 30 amperes, make the connections at the starter motor relay's positive terminal, not at the battery terminal. This will aid battery serviceability.

- For circuits requiring more than 30 amperes, make connections directly to the battery's positive terminal. Route the wire along the battery cable to provide a neater wire routing and assist battery serviceability.

All current load added by body builders should be evaluated for key off loads. If possible, a supply for the load should be ignition key controlled (i.e. RUN only, RUN/START only, etc.). Powered equipment should be evaluated for operation in different operation modes (Transmission in Park, Parking Brake set, etc.). If the operation of the equipment is to be limited to specific operation modes, the power source should be active during the operational mode(s) only.

Key Off Loads

A key off load is defined as a current draw on the battery when the ignition key switch is in the off position. Key off loads are important because they will lower the charge in the battery between vehicle uses.

The key off amperage draw of all equipment connected to the vehicle's main or multiple batteries should not exceed 28 milliamps. If equipment inclusion into the vehicle's electrical system would cause the amperage draw to exceed 28 milliamps, the equipment should be connected to an auxiliary battery or an isolated battery bank.

Hall Effect Sensors are commercially available sensors that detect the magnetic field generated in a wire when electrical current passes the sensor. The sensor allows for determination of the amount of current in the wire without altering the wire. The best practices solution for reading large currents (>20 mA) is utilization of a Hall Effect sensor.

Steady state Key Off Load can be determined utilizing one of the following methods:

Method 1 (Preferred) - Hall Effect sensor

1. Ensure that the vehicle is not in "on" or "accessory" key state and the delayed accessory feature is not active (wait 15 minutes).
2. Connect the Hall Effect sensor to the negative battery cable.
3. Read the current on the Hall Effect sensor's meter. This is your key off load.

Method 2 - Ammeter

1. Ensure that the vehicle is not in "on" or "accessory" key state and the delayed accessory feature is not active (wait 15 minutes).
2. Remove the negative battery terminal from the battery post.
3. Connect an ammeter in series with the negative battery terminal and the negative pole of the battery.
4. Read the current on the ammeter. This is your key off load.

Use of a Hall Effect sensor prevents memory loss in the Powertrain Control Module (PCM) and the radio. Use caution with Hall Effect / Clamp On current meters, many are not sensitive enough to accurately register between 10 and 30 milliamps. In addition, small movements of the meter along the wire may cause large differences in readings.

Battery Relocation

Battery cables should not be spliced. A new, non-spliced, cable should be installed.

Appropriate battery hold-down brackets must be used to retain batteries from shifting.

The hold-down system must allow for a minimum 1" (25 mm) air gap between adjacent batteries.

The battery ground lug and the red positive jumper cable lug must be relocated to a similar position adjacent to the new battery location.

See the "Electrical Wiring – Wire Gauge" section for more information on battery cables.

Auxiliary Batteries vs. Multiple Batteries

An auxiliary battery is defined as a battery that is relay isolated from the primary battery and the alternator. This battery is intended to provide power to "key off" loads (see "Key Off Loads" section for definition) without loss of the primary battery's starting capability. Only circuits that are required to be "Hot at all times" or have significant key off load should be connected to an Auxiliary Battery.

Multiple batteries are defined as two or more batteries being charged from the vehicle's alternator that are electrically in parallel with each other. Utilization of multiple batteries can provide significant power for short periods of time. This power output may even occur at low engine rpm's without adversely affecting the electrical system of the vehicle. Utilization of a wheelchair lift or a snow plow are good examples of such an application.

The utilization of high current (40 Amps or more) "Key On" loads should be handled with a multiple battery alternative rather than an isolated battery.

The 6.7L diesel engine requires two batteries wired in parallel for proper starting operation and must not be isolated.

Fusing and Circuit Protection

Added electrical circuits should be protected by a fuse or circuit breaker, labeled, and positioned to facilitate servicing. Fuses and circuit breakers located in the engine compartment should be sealed to minimize corrosion.

The protection device should be installed as close to the point of tapped power as possible.

Never increase the rating of a factory installed fuse or circuit breaker.

Electrical Wiring - General

All added wiring should be color coded or labeled to aid in identification during service.

All added under hood and under body wiring must be cross linked polyethylene, high temperature (minimum 125 °C) insulated wire. SAE Specification J1128 SXL, GXL, or TXL wire or equivalent is acceptable. Use SAE J1127 SGX or STX or equivalent for battery cables. Interior wiring not exposed to high temperatures may be SAE approved, general purpose wire. See the "Definitions" section for the definition of the terms Under Body and Under Hood.

All added under hood and under body wiring should be protected with high temperature (minimum 125 °C) nylon convoluted tubing.

Connectors, splices and eyelets in the engine compartment, under body or in "wet" areas of the passenger compartment are recommended to be sealed to prevent corrosion and short circuits. Ground the second unit body to the frame in at least two locations, and if required, add an additional frame to engine ground cable to improve the ground path to the battery.

Electrical Wiring - Wire Gage

When adding wiring, the wire gage should be determined as follows:

- Where wire is spliced to extend a circuit, the added wire should have a gauge at least that of the circuit being modified.
- When circuits are added to feed aftermarket devices, the wire gage of the circuit should be determined by referencing the Wire Gage Table (Figure 7). NOTE: The current capacity of a given wire varies with temperature and type of insulation. The table, however, represents generally accepted values as a guide.
- The replacement or extension of any cable from the batteries or alternators must not increase the voltage drop in the circuit. This can be accomplished by increasing the wire gauge, or by adding a parallel cable. Do not modify the alternator battery sense ("A") line circuit. In order to reduce the possibility of environmental conditions resulting in increased starting voltage drop, all battery cable connections should be coated with a corrosion protectant after all connections are torqued.

  Note: Cables in parallel must have appropriate terminals on each end to assure full current carrying capacity of the pair.

Electrical Wiring - Routing & Retention

Wire routings of installed components or wire routing revisions of the Ford harnesses necessitated by reworks must conform to the following:

- Wires routed through holes in sheet metal or castings must have the edges of holes protected by a grommet. Use customer access pass-thru circuits where provided to avoid additional openings between passenger and engine compartments.
- Wires should be routed to avoid metal edges, screws, trim fasteners and abrasive surfaces. When such routings are not possible, protective devices (shields, caps, convoluted tubing etc.) must be used to protect the wires. When wires must cross a metal edge, the edge should be covered with a protective shield and the wiring fastened within 3 inches of the edge.
- Wires must be routed to provide at least 3 inches clearance to moving parts, unless positively fastened or protected by conduit.
- All seat wiring should be properly routed and properly anchored away from any unfriendly surface such as sharp edges and moving parts of the seat track mechanism.
- Existing heat shields, insulation, and wire shielding/twisting must be maintained.
- When wiring is routed between two members where relative motion can occur, the wiring should be secured to each member, with enough wire slack to allow flexing without damage to the wire.
- Wiring to all circuit components (switches, relays, etc.) in exposed locations must provide a drip loop to prevent moisture from being conducted into the device via the wire connection.
- Wiring should not be routed through wheel well areas where they may be damaged by tire or road debris, snow packing, excess water etc. When such routings cannot be avoided, adequate clipping or protective shields are required.
- The wire retainers and grommets installed by Ford are usually designed to accommodate only the Ford-installed wires. Additional wiring or tubing should be retained by additional clips.
- All wiring connections to components of the factory-installed system must be accomplished by using the proper mating wire termination. (Connections on studs and ground connections must use eyelet terminations, connections to female bullets must terminate in male bullets, etc.)
- Transmission of electrical power through a wire will generate an electro-magnetic field around the wire. Wires carrying low power signals may experience induced electric noise in excess of the low power signal if they are near a high power transmission wire. For this reason, high power transmission wires should be routed away from any OEM harnesses. The spacing should be maximized and should never be less than 12 inches (304.8 mm) for battery voltage or one inch (25.4 mm) per volt. Higher voltage alternating current (AC) circuits may require twisted pair or grounded shielding to allow their placement on the vehicle without affecting other circuits.
- All wiring should be protected from fastener damage during the build process (e.g. pinched underneath fastener head, or contacted by backside of fastener extending from joint)
- The use of generic plastic cable ties (aka zip ties) should be limited to bundling the harnesses.

WIRE GAGE TABLE	
Wire Gage	Maximum Current Capacity (Plastic Insulated Copper Wire)
20	10 Amps
18	15 Amps
16	20 Amps
14	25 Amps
12	30 Amps
10	40 Amps

Figure 7 – Wire Gage Table

In addition, for all added under hood and under body wiring:

- Electrical wire should not contact, or attach to, fuel or brake lines.
- Engine compartment wiring must not be rerouted in any manner.
- Added wiring should be located to avoid, or secured away from, rotating or otherwise moving parts (i.e.

cooling fans, engine belts, transmission shift controls, brake or accelerator controls, etc.).
- A minimum clearance of 231 mm [6 in] should be maintained from exhaust system components. Where compliance with this requirement is not possible, heat shields are required.
- A minimum clearance of 38 mm [1.5 in] should be maintained from the engine.

Electrical Wiring - Splice / Repair

When necessary to splice wire for repair or circuit length revisions, the following guide should be followed:

- When stripping wire ends, make sure that individual conductor strands are not damaged.
- When soldering, make sure an adequate mechanical joint exists before applying solder. Use only rosin core solder — never acid core.
- For crimp joints, use butt-type metal barrel connectors and a proper tool (such as Motorcraft crimp tool S-9796) specifically designated for this type of work.
- Splice joints must be adequately sealed and insulated. Adhesive-lined heat shrink tubing is highly recommended to cover soldered and bare metal barrel crimp joints.
- The most durable splice joint will be bare metal, barrel crimped, flow-soldered and covered with adhesive lined heat shrink tubing. This is recommended as the preferred splice joint.
- Heat shrink tubing is effective in preventing strain breakage of small gauge wire (20-22 gauge).
- When splicing or extending the anti-lock brake system (ABS) twisted pair SXL wiring, the OEM specification of one full twist per inch must be maintained as originally provided.
- Battery and Alternator wiring should not be spliced. If these circuits need to be modified, new wire should be used.

Lighting

Incandescent bulb charts are provided in this document (Figure 8) to assist in determining lamp loads.

The Light Emitting Diode (LED) can be used to replace incandescent bulbs. The higher cost of LEDs can be offset by the long life and reduced energy use compared to incandescent bulbs. The low current requirement of LED displays does cause some circuits to perceive a bulb out condition. This situation can be corrected by reconfiguring the BCM to disable bulb outage detection on some vehicles.

Another issue that can be caused by using LED lighting on circuits designed for incandescent bulbs is an intermittent flickering of the installed LED display. Many circuits intended for incandescent bulbs use Pulse Width Modulation (PWM) to ensure the RMS voltage at the bulb does not exceed approximately 13.5v in order to optimize bulb life. LED displays respond much more quickly to changes in line voltage than do incandescent bulbs, resulting in a high frequency flicker of the LED when PWM is active. In some cases the circuit type can be reconfigured from PWM to direct current to prevent this condition. See the program specific BBLB for details on lighting circuit configurability.

When adding Stop Lamp or CHMSL lighting elements to a vehicle, be sure to only use circuits recommended in the program specific IVM or BBLB. Many vehicles are equipped with Advanced Emergency Braking Systems (AEB) where the vehicle system can apply the brakes without input from the driver. If circuits other than those recommended are used for stop or CHMSL lamps, there is a chance that the lamps will not illuminate during AEB (non-driver initiated) braking events.

Incandescent Electrical bulb types used in a particular vehicle are listed in the Owner's Manual Bulb Chart. For replacement bulbs, check for the "DOT" marking on the bulb base which means the bulb meets U.S. "DOT" standards. Use of bulbs without the "DOT" marking or that produce different colors other than the original bulbs as listed in the bulb chart may affect the lamp's light output, aim, glare and your safety; in addition, such bulbs may burn out early or damage the lamp.

BULB CHARTS

BULB TRADE NUMBER	CANDLE POWER	CURRENT @ RATED VOLTAGE
67/97	4	0.69 A @ 13.5V
168	3	0.35 A @ 14.0V
192	3	0.33 A @ 13.0V
194	2	0.27 A @ 14.0V
211-2	12	0.97 A @ 12.8V
212-2	6	0.74 A @ 13.5V
578	9	0.78 A @ 12.8V
579	9	0.8 A @ 12.8V
904	4	0.69 A @ 13.5V
904NA	5.3	0.69 A @ 13.5V
906	6	0.69 A @ 13.5V
912	12	1.0 A @ 12.8V
916	2	0.54 A @ 13.5V
916NA	1.5	0.54 A @ 13.5V
921	21	1.4 A @ 12.8V
922	15	0.98 A @ 12.8V
1157A (major)	24	2.1 A @ 12.8V
1157A (minor)	2.2	0.59 A @ 14.0V
3057 (major)	32	2.1 A@ 12.8V
3057 (minor)	32	2.1 A @ 12.8V
3057K (major)	32	2.1 A @ 12.8V

BULB TRADE NUMBER	CANDLE POWER	CURRENT @ RATED VOLTAGE
3057K (minor)	2	0.48 A @ 14.0V
3155K	21	1.6 A @ 12.8V
3156 (P27W)	32	2.1 A @ 12.8V
3157 (P27/2W) (major)	32	2.1 A @ 12.8V
3157 (P27/2W) (minor)	3	0.59 A @ 14.0V
3157A (major)	24	2.1 A @ 12.8V
3157A (minor)	2.2	0.59 A @ 14.0V
3157K (major)	32	2.1 A @ 12.8V
3157K (minor)	3	0.59 A @ 14.0V
3456K	40	2.23 A @ 12.8V
3457AK (major)	30	2.23 A @ 12.8V
3457AK (minor)	2.2	0.59 A @ 14.0V
3457K (major)	40	2.23 A @ 12.8V
3457K (minor)	3	0.59 A @ 14.0V
3757AK (major)	24	2.1 A @ 12.8V
3757AK (minor)	2.2	0.59 A @ 14.0V
4057K (major)	32	2.23 A @ 12.8V
4057K (minor)	2	0.48 A @ 14.0V
4157K (major)	32	2.23 A @ 12.8V
4157K (minor)	3	0.59 A @ 14.0V
W5W	4	0.4 A @ 12.0V

HALOGEN BULB TRADE NUMBER	CANDLE POWER	WATTS @ RATED VOLTAGE
H1	117	55W @ 12.0V
H3	121	55W @ 12.0V
HB2 (9003) (low)	76	55W @ 12.0V
HB2 (9003) (high)	125	60W @ 12.0V
9005 (HB3)	135	65W @ 12.8V
9006 (HB4)	80	55W @ 12.8V
9007 (HB5) (low)	80	55W @ 12.8V
9007 (HB5) (high)	107	65W @ 12.8V
H13/9008 (low)	—	55W @ 12.8V
H13/9008 (high)	—	65W @ 12.8V
H7	125	55W @ 12.0V
H9	167	65W @ 12.0V
H11	107	55W @ 12.8V
H6054 (low)	—	55W @ 12.8V
H6054 (high)	—	65W @ 12.8V
9140	48	40W @ 12.8V
9145 (H10)	65	45W @ 12.8V

Figure 8 – Bulb Chart

Upfitter Interface Module (UIM)

The Upfitter Interface Module (UIM), also known as Programmable CAN Interface Module (PCIM), is an electronic control module that provides read-access to vehicle information for the purpose of programming output signals to control added equipment such as lift buckets, cranes, motors, salt spreaders, snow plows, etc. It is available as an option on Ford truck models shown in Figure 10. The UIM can also read numerous signals from the upfit system, as provided by the upfitter. All input signals can be utilized to create programmable logic to generate output signals to the upfitter body system, see Figure 8.

Several informational videos are available showing examples of how the UIM may be used to help control added equipment. These videos can be accessed via the Ford Body Builders Advisory Service (BBAS) website at https://fordbbas.com under "Publications". Expand the "Videos" Section to view all available video links.

The UIM outputs are intended as control signals only and are not to be used to provide power directly to equipment. New circuits with external relays must be installed to drive any added equipment.

The UIM does not come pre-programmed for use, it must be configured by the Upfitter using the Project Editor software. See Figure 9 for information on how to obtain the Project Editor software and associated instructions. The UIM Project Editor is compatible with Windows 7 and Windows 8 Operating Systems.

The UIM Project Editor allows the user to program the application logic for each UIM output based on UIM inputs and Vehicle CAN signals. A standard Type B USB 2.0 cable (not included) is required to connect the user's PC to the UIM in order to download the Project Editor application logic to the UIM. The upfitter-created application logic may be uploaded to the UIM while it is mounted in the vehicle or not (i.e. on a workbench).

Figures 11, 12 and 13 provide information on UIM electrical connections. Pin assignments and wire colors for UIM / PCIM connectors C1 and C2 and the supplied wiring harness are provided in the "UIM Owner Guide" for Gen 1, and in the "PCIM User's Guide" for Gen 2.

The UIM Gen-1 reads a wide variety of CAN signals (see Figure 14) from the vehicle in which it's installed. The UIM Gen-1 also is capable of reading up to 10 input signals (9 configurable as either "high" or "low") from the upfitter's installed body system (from proximity sensors, etc.). All of these signals can be programmed in the Project Editor to generate up to 15 output signals (8 "high" and7 "low").

The UIM (PCIM) Gen-2 reads all of the CAN signals of the Gen-1 (see Figure 14) plus the additional signals shown in Figure 15. The UIM Gen-2 also is capable of reading up to 11 input signals (9 configurable as either "high" or "low") from the upfitter's installed system (from proximity sensors, etc.). All of these signals can be programmed in the Project Editor to generate up to 15 output signals (8 "high" and 7 "low").

If you have questions or need assistance with the Ford Fleet Website, contact the Ford Fleet Customer Information Center:

Telephone
1-800-34-FLEET (1-800-343-5338)
Monday-Friday
8:30 AM-5 PM EST

Email
http://www.fleet.ford.com/contact-us/customer-information-center/email-us/

NOTE: Ford Motor Company is not responsible for debugging or verifying the function of the customer-created UIM program files. It is the responsibility of the upfitter to ensure proper function of the software created to complete their upfit.

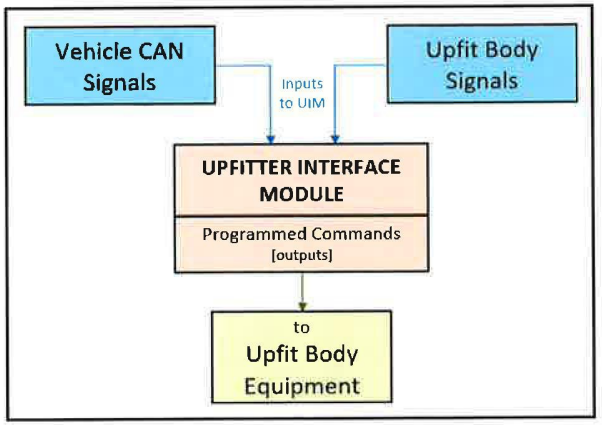


Figure 8 – UIM / PCIM Flow Chart

Gen-1 UIM Page Link

https://www.fleet.ford.com/partsandservice/upfitter-interface/

You need to be logged in to the Ford Fleet site to access the files. [Remember to click on "Ford UIM Terms of Use" and "Agree"]

The following files are available:
- "Read Me First"
- User Manual (for Project Editor Software)
- Owner Guide (for UIM module)
- Project Editor Program (for programming the UIM)

Gen-2 UIM / PCIM Page Link:

http://www.etis.ford.com/help.do

The following files are available:
- PCIM User's Guide
- Project Editor Software (for programming the PCIM)
- Project Editor Installation Guide
- Project Editor User's Manual

Figure 9 – UIM / PCIM Links to Available Documents

Vehicle	Gen 1 UIM	Gen 2 UIM / PCIM
F250 - F550 Super Duty	2017 MY +	N/A
F650 - F750 Medium Duty	N/A	2021 MY +
Transit *	N/A	2020 MY +
E-Series	N/A	2021 MY +

* UIM not available on Transits with split-view camera.

Figure 10 - UIM / PCIM Availability Chart

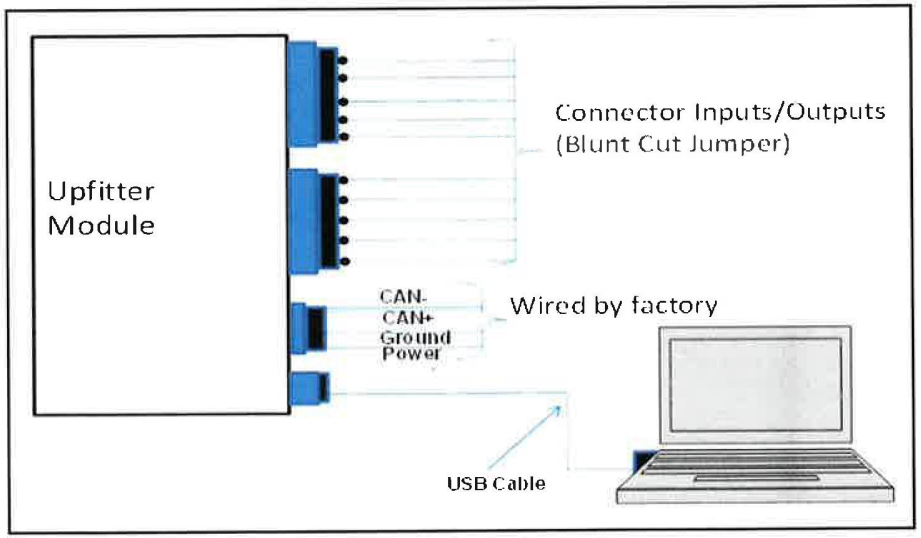


Figure 11 - UIM / PCIM Schematic

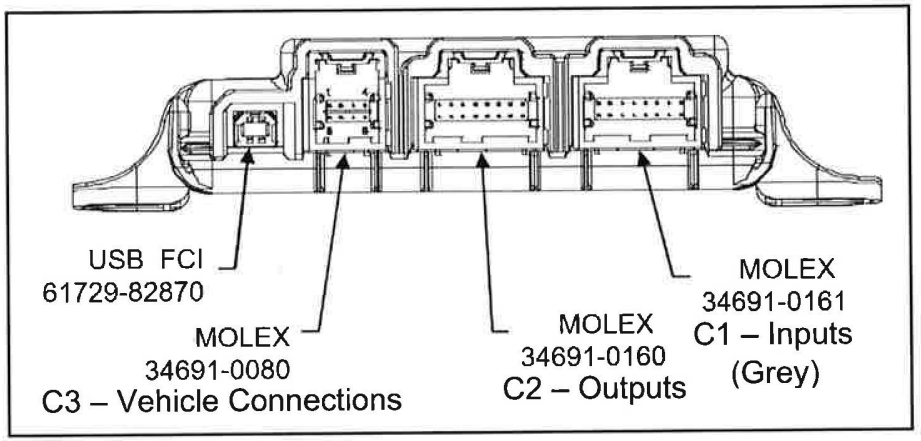


Figure 12 - UIM / PCIM Connector Information

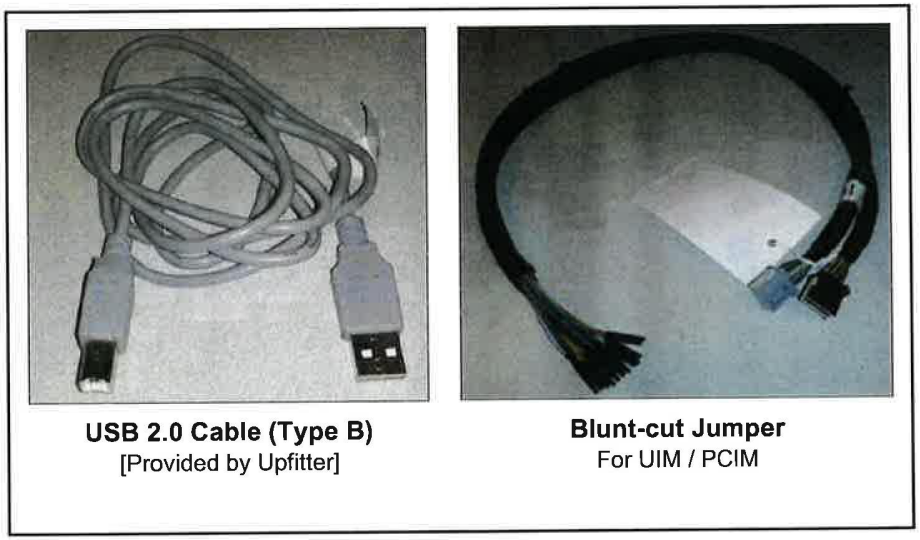


Figure 13 - UIM / PCIM Wiring / Cables

Gen-1 Enumerated Vehicle CAN Signals

1)	Crash Event Status	a) No event b) Deploy event c) Fuel cutoff event
2)	Driver Door Status	a) Closed b) Ajar
3)	Hood Status	a) Closed b) Ajar
4)	Passenger Door Status	a) Closed b) Ajar
5)	Rear Left Door Status	a) Closed b) Ajar
6)	Rear Right Door Status	a) Closed b) Ajar
7)	Ignition Status	a) Off b) Accessory c) Run d) Start
8)	A/C Request	a) Off b) On
9)	Cruise Control Mode	a) Off b) Keeping speed c) Accelerating d) Decelerating e) Resuming high f) Resuming low g) Tap-up waiting h) Tap-down waiting
10)	A/C Compressor Clutch	a) Off b) On
11)	Door Lock Status	a) Double-locked b) All locked c) All unlocked d) Driver unlocked
12)	Malfunction Indicator Light	a) Off b) On c) Flash
13)	Oil Pressure Lamp	a) Off b) On
14)	Driver Seat Belt	a) Faulty b) Belted c) Unbelted
15)	Passenger Seat Buckle	a) Faulty b) Belted c) Unbelted
16)	Restraints Indicator Lamp	a) Off b) On
17)	Crash Event Severity	a) Normal b) Threshold 1 exceeded c) Threshold 2 exceeded
18)	TPMS Status	a) TPMS system fault b) TPMS sensor fault c) Tire pressure low d) Tire pressure normal
19)	Auto Trans Gear Status	a) Neutral b) 1 c) 2 d) 3 e) 4 f) 5 g) 6 h) 7 i) 8 j) 9 k) 10 l) Reverse
20)	Engine Status	a) Off b) On c) Auto-stopped

Gen-1 Analog Vehicle CAN Signals

1)	Vehicle Battery Voltage	> = <	_____ %
2)	Odometer Reading	> = <	_____ km
3)	Fuel Level	> = <	_____ %
4)	Outside Air Temp	> = <	_____ °C
5)	Engine Coolant Temp	> = <	_____ °C
6)	Engine Speed	> = <	_____ RPM
7)	Vehicle Speed	> = <	_____ kph
8)	Transmission Oil Temp	> = <	_____ °C

Input Signals to UIM from Upfitter System

Upfitter Switches #1 – 9	High / Low (configurable)
Upfitter Switch #10	Low Only

Output Signals from UIM to Upfitter System

Switches #1 – 8	High
Switches #9 – 15	Low

Figure 14 – UIM Gen 1 Available Signals

Gen-2 Enumerated Vehicle CAN Signals (incremental to Gen-1)

1)	High Beams	a) Off b) On
2)	Low Beam	a) Off b) On
3)	Rear Fog Lamp	a) Off b) On
4)	Front Fog Lamp	a) Off b) On
5)	Stop Lamp	a) Off b) On
6)	Right Turn Lamp	a) Off b) On
7)	Left Turn Lamp	a) Off b) On
8)	Hazard Lamps	a) Off b) On
9)	Park Lamp Status	a) Off b) On
10)	Headlamp Switch Position	a) Off b) Park c) Headlight d) Auto
11)	Rear Barn / Tail-gate Ajar	a) Off b) On
12)	Manual Trans Gear	a) Reverse b) Other
13)	Brake Pedal Status	a) Off b) On
14)	Parking Brake Status	a) Off b) On
15)	Change Oil Lamp	a) Off b) On
16)	Frost Warning Status	a) Off b) Amber c) Red
17)	Vehicle Alarm	a) Inactive b) Active
18)	Engine Re-crank	a) Not Supported b) Supported c) Shutdown in Progress d) Low Voltage Event e) Fault
19)	RPM Speed Control Mode	a) Off b) 3-speed Mode c) Variable Mode d) Idle-up Mode e) Split-shaft Stationary
20)	Trailer Status	a) Disconnected b) Connected
21)	Trans Oil Temp Valid	a) Default b) Valid c) Missing d) Faulty

Gen-2 Analog Vehicle CAN Signals (incremental to Gen-1)

1)	DPF Regen Level	> = <	In-range, Out-of-Range	_____ %
2)	Smart Regen Charging	> = <	In-range, Out-of-Range	_____ %
3)	Vehicle Tilt Angle	> = <	In-range, Out-of-Range	_____ °
4)	Battery Temp	> = <	In-range, Out-of-Range	_____ °C
5)	Battery Current	> = <	In-range, Out-of-Range	_____ amps
6)	Clutch Pedal Status	> = <	In-range, Out-of-Range	_____ %
7)	Accelerator Position	> = <	In-range, Out-of-Range	_____ %

Other Gen-2 Incremental Capabilities

1) UIM Private CAN-bus 1 Hz output (to upfitter body).
2) Programmer (Project Editor) has 8 logic terms (A-H), was 3 (A-C) in Gen-1.
3) Added "In Range" and "Out of Range" options to Analog CAN Signals logic programming.
4) Can add a virtual logic row in the Project Editor file.
5) Debugger function added to Project Editor (in Tools).

Input Signals to UIM from Upfitter System

Upfitter Switches #1 – 9	High / Low (configurable)
Upfitter Switches #10 – 11	Low Only

Output Signals from UIM to Upfitter System

Switches #1 – 8	High
Switches #9 – 15	Low

Figure 15 – UIM / PCIM Gen 2 Available Signals

Cooling System

To achieve expected performance of the vehicle cooling system, the following recommendations should be heeded:

- Equipment such as lights, sirens, spare tires or any other accessories should not be installed in the grille area forward of the radiator or engine air inlet. Doing so restricts airflow through the radiator and engine compartments. See Figure 16 for illustrated examples.
- All Stripped Chassis and some Chassis Cab models have minimum Effective Front End Opening (EFEO) areas that must be met. This information is provided in the program specific BBLBs.
- Do not alter, change the locations of, or remove the original equipment fan, fan clutch, or shroud.
- If engine coolant is added or replaced, the original coolant type must be used. The appropriate coolant specification can be found in the vehicle Owner's Manual, in the "Capacities and Specifications" section.
- Hoses which are added or replaced should be of the following type:
  - Radiator Hoses: EPDM Rubber reinforced with modified para-aramid fibers.
  - Heater Hoses – Supply Port: EPDM Rubber reinforced with meta-aramid or modified para-aramid fibers.
  - Heater Hoses - Return Port: EPDM Rubber reinforced with modified para-aramid fibers.
- All sections of hose with clearances less than 5 mm to adjacent components must have protective sleeve of Flexguard 2130 or Delfingen Langoflex PET-PA D.

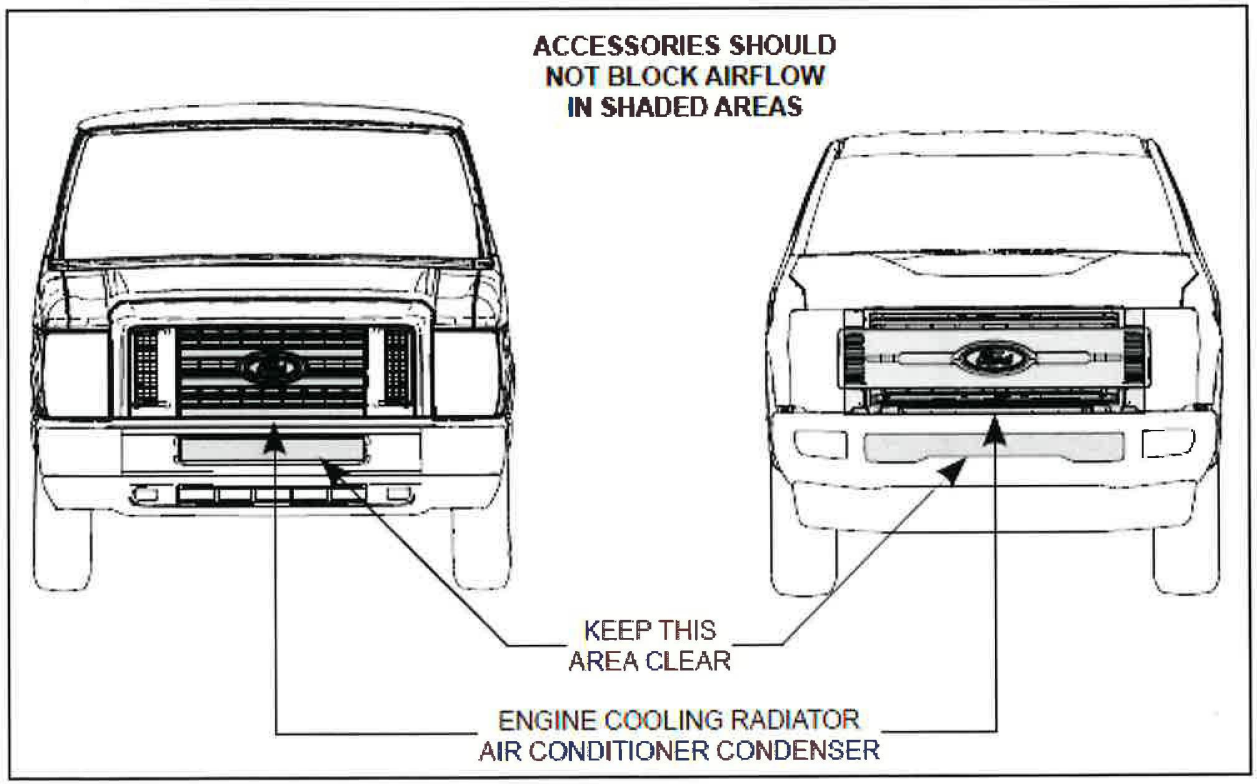


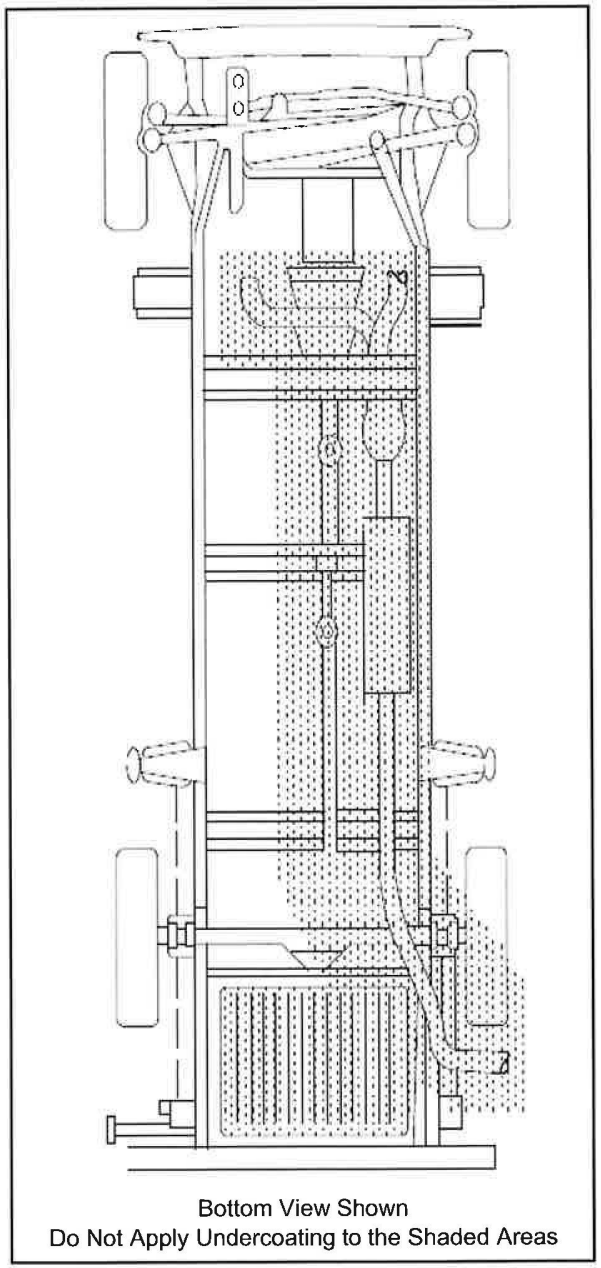
Figure 16 – Examples of Areas Critical to Cooling

- On Stripped Chassis models, the upper radiator hose must be retained to the fan shroud to avoid damage to the hose during vehicle operation. Otherwise, additional components should not be attached to the radiator or fan shroud.
- Revisions to the Front End Accessory Drive System may affect the cooling system/component performance and are not recommended.
- Do not alter or modify the automatic transmission cooling system.
- Do not modify or remove any seals which are part of the cooling module (i.e., body seals, condenser seal, radiator seals, snow shield). These shields are intended to prevent engine heat recirculation.

Climate Control System

Some vehicles have an available Auxiliary Climate Control Prep Package that can be helpful in connecting auxiliary climate control systems to the Ford system. The following items are important for the maximum efficiency of the combined systems:

- A label stating the total refrigerant charge, type of refrigerant and type of compressor lubricant oil used must be affixed in a conspicuous place in the engine compartment.
- The A/C compressor will cycle during the defrost mode. A refrigerant shut-off valve for the auxiliary system may impair compressor lubrication.
- R-134A charged A/C systems should use barrier type A/C hose. Swaged, permanent fittings are recommended for this type of hose.
- The amount of OEM provided oil should be sufficient to support the additional auxiliary HVAC unit. However, an aux HVAC unit will require additional refrigerant to be added, and the refrigerant amount needs to be defined by a refrigerant charge determination test.
- When attaching an aftermarket AUX A/C unit to an existing OEM front A/C system, the AUX A/C unit must use a Thermal Expansion Valve (TXV). A Clutch Cycling Orifice Tube (CCOT) cannot be used.



Bottom View Shown
Do Not Apply Undercoating to the Shaded Areas

Figure 17 – Undercoating "Keep Out" Areas

- Compressor discharge gas temperature should never exceed 130°C [266°F] under any driving or idle conditions.
- Do not alter or change the FEAD pulley size.

Auxiliary heater and air conditioning system hose routings must consider the following:

- Dynamic engine roll or any system component which has an operating zone. Make sure there is adequate clearance to accommodate movement (e.g., transmission downshift linkage, steering column shift linkage).
- Route away from exhaust system components and add heat shields where necessary
- Do not route hoses by attaching to the engine.
- Use only metallic "Y" and "T" type fittings or OEM approved materials.
- Do not route hose in the wheelhouse area.
- Do not route hose by sharp edges or moving component parts. There must be shield protection from any potential abrasive source.
- When routing in stone kick-up area, lines should be protected by shields. Minimize the use of concentric protective heater hose shields. Limit length of concentric hose shields to 305 mm [12 in] maximum.
- Where possible, encase added suction lines in insulating foam from connector location under body to the secondary evaporator.

Exhaust System

Warning: Vehicle Operating Temperatures: Some trucks manufactured by Ford Motor Company may exhibit high engine compartment and exhaust system temperatures in certain operating modes. Components, including exhaust heat shielding systems, have been installed as standard equipment on some vehicles in an effort to provide thermal protection against such temperatures. Aftermarket equipment installers, alterers, intermediate and final stage manufacturers are responsible for providing thermal protection (e.g., under body heat shields) for any structure or equipment added to the vehicle and SHOULD NOT REMOVE ANY COMPONENTS OR EXHAUST HEAT SHIELDING INSTALLED ON THE VEHICLE BY FORD MOTOR COMPANY.

- Exhaust heat shields should be added and should extend far enough beyond the exhaust system components to protect under body surfaces from heat radiated at any angle. Preferred method of attachment is banding, but welding is acceptable as long as it does not compromise the structural integrity or create a leak. Consider weld wire/band materials, they need to be equivalent to the OEM exhaust component material and compatible with the heat shield material.
- New exhaust pipe segments must include equivalent grass heat shields and top mounted heatshields as originally provided by Ford. These added shields must be of equivalent material and thickness. Depending on shield position, consider adding drain holes to prevent fluid retention.
- Do not apply body undercoating on the fuel tank, fuel fill hose, or fuel fill vent hoses. The extra insulation on these components may cause excessive heat build-up or possible material incompatibility concerns.
- Do not apply body undercoating within twelve inches of the area directly above the exhaust, on any components within twelve inches of the exhaust, or to any part of any exhaust system. See Figure 17. Undercoating will smoke or burn if subjected to high heat.

To achieve expected exhaust system function, vehicle performance and effective heat management, the following recommendations should be heeded:

- Do not substitute or remove exhaust system components furnished by Ford, except as noted in the program specific BBLB.
- For modifications to Diesel engine exhaust systems: the Maximum WOT Backpressure as measured at the end of the turbocharger outlet pipe must not exceed the value as produced by Ford under equivalent operating conditions.
- For modifications to Diesel engine exhaust systems: The maximum tail pipe outlet exhaust gas temperature versus time curve during the Diesel